UM11546

Angle calculation component user manual

Rev. 1 — 28 January 2021 User manual

Document information

Information	Content
Keywords	Component Library, Angle Calculation
Abstract	Getting started with angle calculation component

1 Prerequisites

Prior to using this platform agnostic component library, angle calculation component, this document assumes that the user is familiar with the:

- Chosen microcontroller unit (MCU)
- Corresponding software development kit (SDK)
- Cross-compilation tool chain to integrate the angle calculation component.

2 Overview

The angle calculation component provides platform independent angle calculation utilities for pitch and roll angles. The component has both floating point and fixed-point implementations. There are two main implementation methods, one, with 2D plane, and other with a 3D plane. The 2D plane functions are designed for application with ±65 angle range, whereas 3D planes are designed for for high sensitivity application with ±84 angle range. All the implementations are optimized by considering efficiency in terms of power and memory and the accuracy level in the approximate range of ±1 degree.

2.1 Angle Calculation component design

The angle calculation component is a development model providing a platform independent design philosophy. The component uses lightweight 16-bit fixed-point abstraction to access a user-defined fixed-point library or proprietary component. The component runs as a standalone application space in the application space or runs in a multi-threaded environment. In the multi-threaded environment, the user application is responsible for handling the multi-threading synchronization and resource handling. The component is designed to work seamlessly in any SDK environment and application resource handlers.

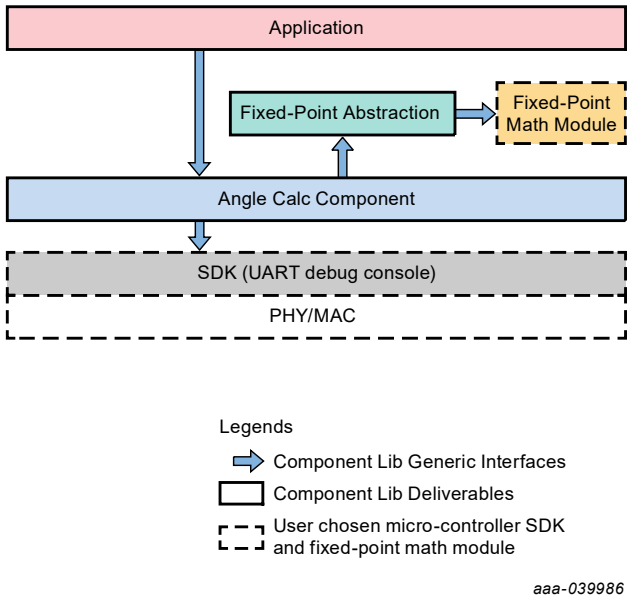

Figure 1. Angle calculation component design

3 Angle calculation component integration

The angle calculation component is designed to be microcontroller agnostic. This section describes development steps to integrate angle calculation component into any microcontroller software development kit (SDK). Users may simply use the existing source files for compilation in any platform. The angle calculation component expects acceleration data as the input. Users may integrate any low-g accelerometer data, and feed the data into this interface. The angle calculation component is an internal 16-bit fixed-point arithmetic value for fixed-point implementation. It is important to identify the desired fixed-point implementation and embed the implementation into interfaces defined in the fixed_point_abs.h.

3.1 Angle calculation component directory structure

This section provides a snapshot of the angle calculation component directory structure. The below provided snapshot shows directory structure for the angle calculation component:

```
Angle Calc/
|-- src
|   |-- angle_calc.c
|   |-- angle_calc.h
|-- example
|   |-- MCUXpresso
|   |-----frdmkl25z_angle_calc
            `-- docs
|   |-- CompLib_Angle_Calc_UG.docx
|   |-- AngleCalc_API_Reference_Manual.zip
common/
|-- fixedpoint_abstraction
|   |-- fixed_point_abs.h
```

The reference example project for testing angle calculation component integration with MCUXpresso SDK is available under “example” folder.

3.2 Angle calculation component content overview

This section provides a brief overview of the angle calculation component source file contents and file descriptions:

```
Angle Calc/
|-- src[1]
|   |-- angle_calc.c[2]
|   |-- angle_calc.h[2]
|-- example[3]
|   |--MCUXpresso[4]
        <project_name>[5]
`-- docs[6]
|   |-- CompLib_Angle_Calc_UG.docx[7]
|   |-- AngleCalc_API_Reference_Manual.zip[8]
common/
|-- fixedpoint_abstraction[9]
|   |-- fixed_point_abs.h
```

[1]Folder containing angle calculation component source files.
[2]Files containing angle calculation implementations.

[3]Folder containing angle calculation integration example with MCUXpresso SDK.
[4]Component libraries are provided with the NXP MCUXpresso SDK integration example application. The integration test example applications demonstrate how to integrate platform agnostic component libraries with underlying microcontroller SDK communication interfaces using virtual interface abstraction provided by component libraries.
[5]Folder containing angle calculation integration example for with MCUX.
[6]Folder containing release documentation for angle calculation component.
[7]Angle calculation component user manual.
[8]Angle calculation component API RM.
[9]Folder containing fixed-point math abstraction.

Note: *Before importing component library example projects for the standalone MCUXpresso IDE, the standalone MCUXpresso IDE requires the corresponding microcontroller SDK package to be downloaded and installed on the IDE.*

4 Revision history

Table 1. Revision history

Revision number	Date	Description
1	20210128	Initial release

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